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**BOILERPLATE NUMBER 4, COMMAND MODULE WATER
IMPACT TEST SPECIFICATION
PROJECT APOLLO SPACECRAFT
(Unclassified)**

28 February 1962

Approved By

J. W. Paup 2/21
J. W. Paup
Vice President and Apollo Program Manager

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**NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION**



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1. SCOPE

1.1 Scope. - This specification covers requirements for the Command Module Water Impact Test Boilerplate. The boilerplate shall be used to test the earth impact attenuation system and crew shock absorption system of the command module.

2. APPLICABLE DOCUMENTS

2.1 General. - The following documents shall form a part of this specification.

Government Documents

Air Force

ARDCM-80-1,
Volume 1

Handbook of Instructions for Aircraft
Designers

National Aeronautics and Space Administration

NCP200-2

Quality Assurance Provisions for Space
Contractors, dated 15 December 1961

Space and Information Systems Division, North American Aviation, Inc.

SID 62-240

Preparation for Delivery of Airborne
Equipment, General Requirements for

3. REQUIREMENTS

3.1 General. - The configuration of the Command Module Water Impact Test Boilerplate shall be similar to the configuration of the prototype command module. The boilerplate configuration is shown in Figure 1.

3.2 Components. -

3.2.1 Boilerplate Sections. - The Command Module Water Impact Test Boilerplate shall consist of a cabin section and a lower compartment (Ref. Fig. 1).

3.2.1.1 Cabin Section. - The Cabin Section of the boilerplate shall include the following:

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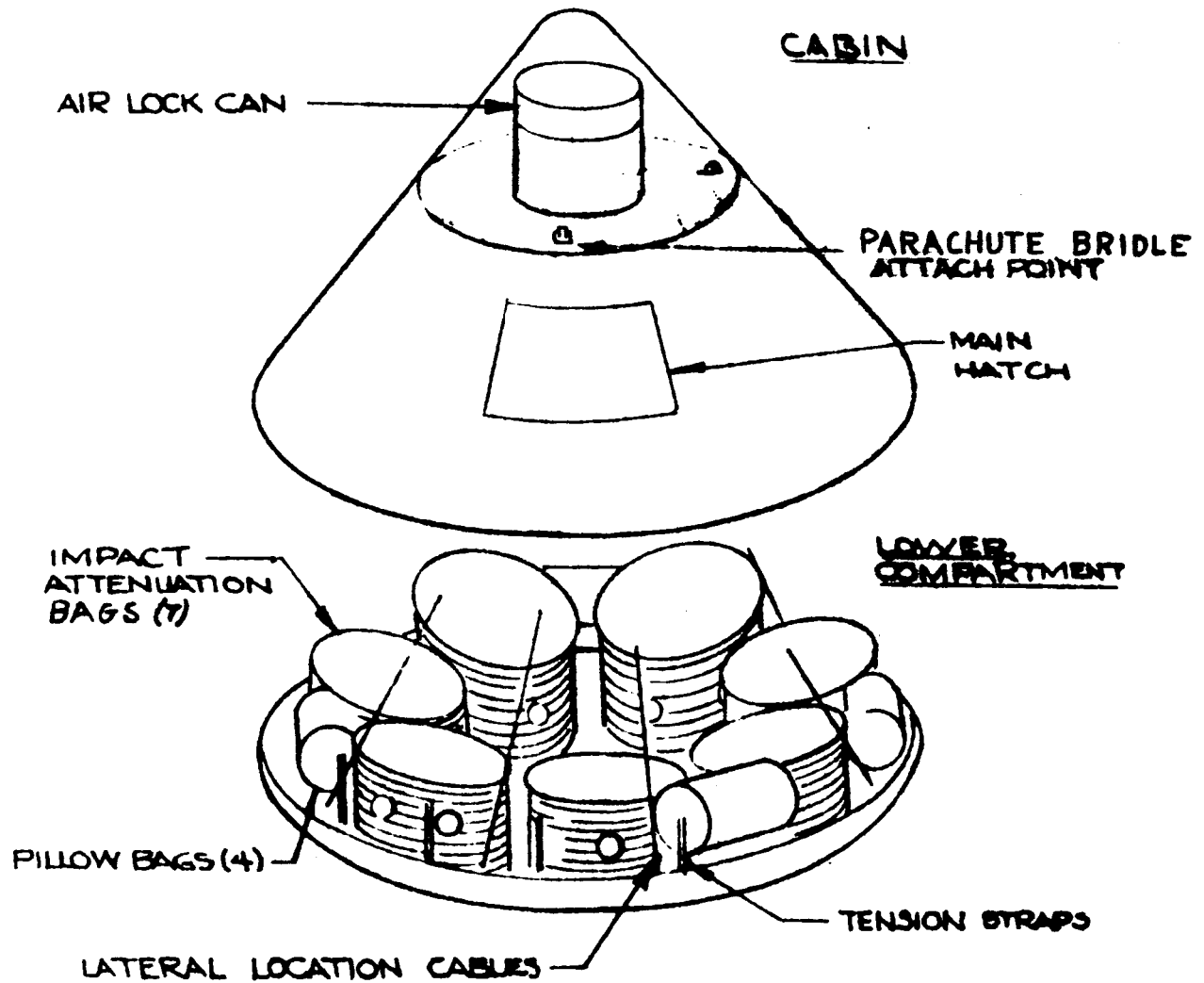
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Figure 1. Boilerplate Number 4

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- (a) Cabin housing
- (b) Main hatch
- (c) Restraint and support equipment
- (d) Anthropomorphic dummies (with test instruments)
- (e) On board instrumentation
- (f) Parachute bridle attach points
- (g) Air-Lock

3.2.1.1.1 Cabin Housing. - The cabin housing of the boilerplate shall be similar to the cabin housing of the prototype command module.

3.2.1.1.2 Main Hatch. - The main hatch of the boilerplate shall provide ingress and egress for personnel.

3.2.1.1.3 Restraint and Support Equipment. - The restraint and support equipment for the dummies shall be similar to the crew restraint and support equipment of the prototype command module.

3.2.1.1.4 Anthropomorphic Dummies. - The anthropomorphic dummies used in the boilerplate shall be instrumented with testing equipment.

3.2.1.1.5 On Board Instrumentation. - The on board instrumentation in the boilerplate shall include:

- (a) Seven pressure transducers (Bridge Type)
- (b) 27 accelerometers (Bridge Type)
- (c) Strain gauges, as required

3.2.1.1.5.1 Pressure Transducers. - The pressure transducers shall record the impact of the water on the impact attenuation bags.

3.2.1.1.5.2 Accelerometers. - The accelerometers shall be used to record the forces on the shock absorption equipment during testing.

3.2.1.1.5.3 Strain Gauges. - The strain gauges shall be used to record lateral and transverse strains on the boilerplate during testing.

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3.2.1.1.6 Parachute Bridle Attach Points. - Parachute bridle attach points shall be used to support the boilerplate in the test stand (Ref. Fig. 1).

3.2.1.1.7 Air Lock. - The air lock of the command module shall be simulated in the cabin section of the boilerplate.

3.2.1.2 Lower Compartment. - The lower compartment of the boilerplate shall not be affected by water. The lower compartment shall include the impact attenuation system. The impact attenuation system shall include:

- (a) Seven impact attenuation bags
- (b) Four pillow type impact attenuation bags
- (c) Tension straps, as required

3.2.1.2.1 Impact Attenuation Bags. - The boilerplate shall contain seven impact attenuation bags. The impact attenuation bags shall be located around the inside perimeter of the lower compartment as shown in figure 1.

3.2.1.2.2 Pillow Type Impact Attenuation Bags. - Four pillow type impact attenuation bags shall be installed in the lower compartment of the boilerplate. The arrangement of the bags shall be as shown in figure 1.

3.2.1.2.3 Tension Straps. - Tension Straps shall be installed in the lower compartment of the boilerplate to aid in the support of the large attenuation bags. (Ref. Fig. 1)

3.2.2 Equipment. - The equipment for the boilerplate shall include the equipment listed in Appendix I-A.

3.3 Performance. -

3.3.1 General. - The water impact of the prototype command module shall be simulated in the test of the boilerplate. The water impact landing shall be recorded by a motion picture camera. The boilerplate shall be capable of withstanding at least 15 test drops.

3.4 Design and Construction. -

3.4.1 General. - The boilerplate shall be constructed of the materials necessary to insure structural soundness and stiffness with respect to impact absorption. ARDCM-80-1, Volume 1, shall be used for guidance and reference material in the design and construction of the boilerplate.

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3.4.2 Weight. - The boilerplate shall have a mass and center of gravity similar to the mass and center of gravity of the prototype command module.

3.4.2.1 Center of Gravity. - The center of gravity of the boilerplate shall be placed to give the boilerplate an impact angle of minus 15 degrees forward, when the crew is in the feet forward position.

3.4.3 Heat Shielding Simulation. - The boilerplate shall not contain heat shielding. The stiffness of the heat shielding of the command module shall be simulated in the boilerplate.

3.4.4 Attachment. - The cabin section and lower compartment section of the boilerplate shall be joined by retaining straps, as required.

3.4.5 Water Protection. - The boilerplate shall be watertight.

3.5 Ground Support Equipment. -

3.5.1 Ground Handling Equipment. - Ground Handling Equipment shall be required to transport, demonstrate and test the boilerplate. The requirements for Ground Handling Equipment are not part of this specification.

4. QUALITY ASSURANCE PROVISIONS

4.1 General. - Quality Assurance Provisions for the boilerplate shall be in accordance with the applicable portions of NASA Bulletin NCP200-2.

4.2 Inspection and Tests. - Inspections and tests to determine conformance of the boilerplate to contract and specification requirements shall be conducted prior to delivery to the test site.

5. PREPARATION FOR DELIVERY

5.1 Airborne Equipment. - Airborne equipment shall be prepared for delivery in accordance with Specification SID 62-240.

5.2 Transportation. - The boilerplate shall be delivered to the local area testing site by the contractor.

6. NOTES

6.1 Definitions. - A boilerplate is a simulated spacecraft module for pre-developmental and/or developmental tests leading to the design of a prototype module.

~~CONFIDENTIAL~~Appendix I-AContractor-Furnished Equipment, Contractor-InstalledCOMMUNICATIONS AND INSTRUMENTATION

<u>Item No.</u>	<u>Quantity</u>	<u>Description</u>	<u>Part No.</u>
1	7	Pressure Transducers (Bridge Type)	
2	27	Accelerometers (Bridge Type)	
3		Strain Gauges	

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<u>CREW SYSTEM</u>		<u>Part No.</u>
<u>Item No.</u>	<u>Description</u>	
1	Anthropomorphic Dummies	
2	Restraint and Support Equipment (seats)	

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<u>STRUCTURES</u>		<u>Item No.</u>	<u>Quantity</u>	<u>Description</u>	<u>Part No.</u>
	1	7		Large Impact Attenuation Bags	
	2	4		Pillow Type Impact Attenuation Bags	
	3			Tension Straps	

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